Memorandum

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Reconstruct Interchanges

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: District Preliminary Geotechnical Report

Introduction

As per your request, a District Preliminary Geotechnical Report (DPGR) is provided for the Linden-Casitas Pass Interchanges Project. The purpose of this report is to provide preliminary cut and fill slope recommendations and describe the presence of any geotechnical conditions that may influence the design of this project.

In addition, preliminary recommendations for the selection of retaining wall type and sound wall type are presented based upon the anticipated foundation conditions at the wall locations and the wall heights. These recommendations are based on project information supplied by design, a field inspection of the project site, a review of the freeway as-built plans, and a preliminary subsurface investigation.

Pertinent Reports and Investigations

The following reports were reviewed for the preparation of this report.

1) *Preliminary Geotechnical report* for 05-SB-101-KP 3.5/5.3, 05-448200 by Geotechnical Services, dated December 21, 2000.

A field review of the project area has been performed by personnel from this office to determine potential geologic and geotechnical issues that may impact the construction and performance of the facility over its design life. The information presented herein is based on the site reconnaissance and literature search, and an analysis of the proposed design. Actual conditions in the project area may differ from those assumed in this report. The information presented in this report is for planning and scoping purposes only. Additional investigations and analyses will be required to fully develop and support design recommendations.

Existing Facilities and Project Alternatives

The project proposes to construct new ramp connections, new highway overcrossings, two new creek crossing structures, a new frontage road extension, and new bike lanes. In addition, the elevation of the highway profile will be increased. Several retaining walls and sound walls are also proposed as part of these improvements.

Route 101 through the project area is a four lane freeway with 3.6 meter lanes, 2.4 meter outside shoulders, 0.6 meter inside shoulders, and a median width of approximately 10.8 meters. The roadway in the project area was constructed under contract 55-5VC-4, which extended from PM 1.97 to PM 5.44 with a plan approval date of January 11, 1954.

Route 101 through most of the project area was constructed on a depressed roadbed from the beginning of the project at Carpinteria Creek to approximately 60 meters north of the Linden Avenue Overcrossing. Route 101 then transitions to embankment to the end of the project limits. All cut and fill slopes in the project area are shown on the as-built plans as having been constructed at a slope angle of 1:2 (V:H) or flatter. The slopes are well vegetated and performing well with no signs of erosion or instabilities. At the north end of the Linden Ave Overcrossing, roadway patching at the end of the bridge indicates foundation soil settlement has occurred beneath the structure approach embankment.

The Casitas Pass Road Separation at PM 2.64 is a three-legged diamond interchange. The Linden Avenue Overcrossing at PM 3.06 is a two-legged interchange. The separation and overcrossing were constructed under Contract 54-5VC2 with a plan approval date of January 24, 1953. The Casitas Pass Road Separation and the Linden

Avenue Overcrossing were both constructed with closed end bridge abutments and Type 1 retaining wall wingwalls. The abutments, center bents, and wingwalls are all pile supported. There is visual evidence that the top of the Type 1 retaining wall wingwalls have rotated out approximately 25 mm where the top of the wingwalls adjoin the bridge abutment. This is occurring at the abutment wingwalls on both the Casitas Pass Road Separation and the Linden Avenue Overcrossing.

The proposed project consists of four similar alternatives. Each alternative is consistent in the southern portion of the project limits. The alternatives vary at the northern limits. Specifically, the alternatives vary for number of lanes required for the new Linden Avenue overcrossing and the layout of the intersection and northbound onramp at Via Real and Linden Avenue.

At Carpinteria Creek, south of Casitas Pass Road, it is proposed to replace and widen the northbound and southbound highway structures. The frontage road, Via Real, will also be extended to Casitas Pass Road and will include a new structure over Carpinteria Creek. In addition, the existing bike path will be removed and replaced with a new bike path.

At the Casitas Pass Road Separation it is proposed to construct a new overcrossing, remove the existing northbound off-ramp and construct new northbound on and off ramps that will connect to the proposed Via Real extension, and upgrade the existing southbound on and off ramps.

Between Casitas Pass Road and Linden Avenue, it is proposed to extend the existing Via Real to Linden Ave. The existing northbound on ramp along Via Real will be removed. The alternatives under consideration near the intersection of Via Real and Linden Avenue vary with respect to the location of the new northbound onramp configuration that includes a roundabout in one alternative.

At the Linden Ave Overcrossing, it is proposed to construct a new overcrossing, remove and relocate the existing southbound offramp, and construct a new northbound onramp. Under two of the alternatives, it is also proposed to widen the existing northbound Franklin Creek Bridge.

To alleviate potential flooding issues in the Franklin Creek area, it is proposed to increase the height of the highway by several meters to prevent flood waters from leaving the Carpinteria Creek drainage. Currently, flood waters from the Carpinteria

Creek drainage flow northbound along the highway, and increase the flooding potential in the vicinity of the Franklin Creek area. The result of elevating the highway profile will require an increased structure elevation at Casitas Pass Road Overcrossing and thus require the cooresponding approach and departure fill heights to be increased.

To accommodate the proposed alternatives, several retaining walls and sound walls have been proposed. The proposed maximum wall heights vary from 0.6 meters to 6.4 meters and vary in length from 29.7 meters to 289.3 meters. The proposed sound wall heights vary from 2.4 meters to 3.7 meters and vary in length from 27.7 meters to 370.9 meters.

Physical Setting

The Carpinteria Valley is a sunken area north of the elevated coastal fault block southeast of Carpinteria. The valley is a low lying, almost level plain filled with alluvium. Its lowest area is partly submerged under brackish water of the Carpinteria slough. The plain is open to the sea on the southwest. It gradually rises to the east, and to the north it abuts sharply against the foothills.

Climate

The project area has a coastal climate that is mild throughout the year, with marine fog prevalent during summer nights. Nearly all precipitation falls from Pacific storms between October to May, but mainly in the winter months. The average yearly rainfall is 17.5 inches. The average temperature range is from 45 to 72 degrees with more than 275 days of sunny weather per year.

Geology and Soil Conditions

The project area occurs within the Transverse Ranges Geomorphic Province. Route 101 is bordered to the north by the Santa Ynez Mountains and to the south by the

Pacific Ocean. The project area is within the Carpinteria Basin, which consists of a low-lying alluvial plain with bordering mountain slopes and terraces. The Recent age younger alluvium consists of unconsolidated deposits of clay, silt, sand, and gravel.

Ground Water

Regional ground water in the project area is classified as high. Ground water levels measured via open observation wells installed in boreholes show the ground water level is very close to the ground surface in the study area. Water levels range from 1.33 meters to approximately 5.65 meters below the ground surface. The water level data at specific boring locations is shown on the attached Log of Test Borings.

The As-built Log of Test Borings for the Linden Avenue Overcrossing show that ground water levels range from 0.9 meters to 1.1 meters below the ground surface. The As-built Log of Test Borings for the Casitas Pass Road Separation shows that ground water levels range from 2.9 meters to 3.9 meters below the ground surface. The As-built Log of Test Borings for the Carpinteria Creek Bridge and the Bridge Across Franklin Creek show that ground water levels are 2.4 meters and 0.6 meters below the ground surface respectively.

The Soil Survey of Santa Barbara County prepared by the U.S. Department of Agriculture reports that the ground water table in the project area varies between 0.9 and 1.8 meters below the ground surface in the summer and 0.3 to 0.6 meters in the winter.

Seismicity

The project area is located within a seismically active region of California. As determined by Caltrans, the following are the active and potentially active faults that have the greatest potential of influencing the site along with the Moment Magnitude, distance to the site and the expected maximum bedrock accelerations.

Fault	Magnitude	Distance	Acceleration
More Ranch-Arroyo Parida	7.5	3 km	0.64g (gravity)
Mesa-Rincon Creek	7.0	1 km	0.63g
Santa Ynez	7.5	9.5 km	0.45g
Red Mountain	7.25	8 km	0.45g
Pitas Point-Ventura	7.25	10.5 km	0.39g

The fault that has the greatest potential to influence this site is the More Ranch-Arroyo Parida. The maximum credible Moment Magnitude as determined from Caltrans is 7.5. The maximum credible bedrock acceleration at the project site is 0.7g (see Attachment 6) according to Caltrans attenuation curves for rock or stiff foundation soil. The

The 0.7g attenuation curve on the attached seismic map runs through the middle portion of the project. The final bridge structures, retaining walls, cut slopes, and embankment slope designs will be analyzed individually for seismic susceptibility and the proximity to the respective faults mentioned above.

Liquefaction

Liquefaction potential in the project area is considered moderate according to the Seismic Safety and Safety Element that was adopted by the Santa Barbara County Board of Supervisors. In the project area, results from the subsurface investigation show that the foundation soils are predominantly fine grained with greater than 40 percent finer than the 75-μm sieve size. These soils generally have a low potential for liquefaction. Lenses of loose, clean sands were encountered during the investigation that are susceptible to liquefaction. These lenses were relatively thin and did not have a large aerial extent. Liquefaction is the partial or complete loss of strength of a loose, saturated, cohesionless soil due to the build-up of excess hydrostatic pressure due to ground shaking.

At the proposed bridge locations, a comprehensive liquefaction study for each structure will be completed.

Corrosion

The department considers a site to be corrosive to the foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

Minimum Resistivity of 1000 ohm-cm or less

PH of 5.5 or less

Corrosion samples will be obtained during future subsurface investigations for the individual retaining walls and structures.

The proposed project is not located within 300 meters of the Pacific Ocean therefore no special consideration will be needed due to exposure to the marine environment.

Exploration

A field investigation consisting of subsurface drilling, electronic cone penetrometer soundings, and field mapping was performed for this project in September 2000. Results from the subsurface drilling can be seen in the "Log of Test Borings" attached to this report. All of this information was used to determine the nature, extent, and properties of the subsurface materials.

The electronic cone penetrometer (CPT) uses a cone on the end of a series of rods pushed into the ground at a constant rate. Constant measurements are made of the resistance to penetration of the cone in the form of tip resistance at the end of the cone and frictional resistance on the friction sleeve behind the tip of the cone. The CPT was used for stratigraphic logging and a preliminary evaluation of soil strength and compressibility.

During the drilling operations all materials were sampled and classified. The Unified Soil Classification System (USCS) was used for categorizing soils. Soil descriptions for all of the borings were based upon conventional methods from visual inspection (i.e., soil type, color, texture, cementation, consistency / relative density, etc.).

Borehole sampling techniques consisted of Standard Penetration Test (SPT) sampling and continuous coring utilizing a punch core system. SPT sampling was used for soil field classification and to determine consistency in cohesive soils and relative density in cohesionless soils. Soil strength parameters were also estimated using SPT testing in cohesionless soils. The pocket penetrometer and torvane was used on cohesive soil samples obtained from SPT and punch core testing to approximate unconfined compressive strength and undrained shear strength.

Sub Surface Soil Conditions

Subsurface soils at the project location are generally interbedded sands, silts, and clays with mixtures of these components. The CPT soundings show the variability of soil types and foundation soil strength at the project location. This is typical of flood plain valleys that are filled with alluvium deposited in a low energy environment from the outwash of streams and drainages. The layers of different soil types are generally 0.3 to 0.6 meters thick with layers to 5 meters thick.

The As-built log of test borings for the Carpinteria Creek Bridge (Br. No. 51-0052) indicate that the area is underlain by approximately 10 meters of loose to dense sand, clayey sand and sandy clay above stiff to very stiff clay and silty clay. One mud rotary borings and two penetrometer soundings were performed as part of the foundation investigation in 1951. The ground surface elevation of the borings was approximately 9.2 meters (27.8' to 32.4'). The ground water surface elevation was determined to be at elevation 7.3 meters (24.0').

The As-built Log of Test Borings for the Casitas Pass Road Separation (Br. No. 51-175) indicate that the area is underlain by approximately 5 meters of very loose to compact silt and silty sand above slightly compact to compact silt, clayey silt, and silty sand. Three mud rotary borings and one penetrometer sounding were performed as part of the foundation investigation in 1951. The ground surface elevation of the borings was approximately 14.3 meters (46.6' to 48.6'). The ground water surface elevation was determined to be from elevation 12.0 meters to 10.5 meters (39.5' to 34.5').

The As-built Log of Test Borings for the Linden Avenue Overcrossing (Br. No. 51-117) indicate that the area is underlain by approximately 5 meters of soft sandy clay and clayey silt above slightly compact sand and very stiff clayey silt and silt. One mud rotary boring and four penetrometer soundings were performed as part of the foundation investigation in 1951. The ground surface elevation of the borings was approximately 6.7 meters (21.8' to 22.4'). The ground water surface elevation was determined to be approximately at elevation 5.6 meters (18.1' to 18.9').

Six CPT soundings along the southbound shoulder of Route 101 and one mud rotary boring at the end of west Vallecito Road were used to characterize the subsurface soils between Linden Avenue to the Casitas Pass Road southbound offramp. Boring B-4, approximately meters left of station 143+00 "CSBOFF1"", elevation 12.2 meters, (37 m Lt. 46+10 Route 101) encountered approximately 7.5 meters of very loose to medium dense silty sand overlying at least 7 meters of interbedded loose to medium dense sandy silt, silty sand and firm to stiff lean clay. The six CPT soundings were located between 46+00 "H1" and 49+50 "H1". Subsurface soils encountered were interbedded silty sand, sandy silt, silt, clayey silt, silty clay, sandy clay, and clayey sand.

One CPT sounding along the shoulder of Route 101 and two mud rotary borings adjacent to the existing southbound Linden Ave. off-ramp were used to characterize the subsurface soils for the new southbound Linden Ave. off-ramp. Boring B-1, Approximate LOL station 242+50 "LSBOFF1", elevation 5.91 meters, encountered very loose, interbedded silt and silt with sand to approximately 4.5 meters overlying at least 8 meters of interbedded very loose to medium dense silt, silt with sand, silty sand, and soft to stiff lean clay. Boring B-2, approximately 12 meters left of station 240+20 "LSBOFF1", elevation 7.53 meters, encountered very loose to loose silt, silt with sand, silty sand, and soft to stiff lean clay to approximately 12 meters overlying loose to medium dense silt with sand and silty sand and stiff lean clay to 18 meters overlying dense silty sand.

Three CPT soundings along the shoulder of Route 101 and one mud rotary boring at the end of Linden Ave were used to characterize the subsurface soils along the proposed northbound Linden Ave. on-ramp. The three CPT soundings were located along

"LNBON" which has varying stationing due to different onramp configurations. Subsurface soils encountered were interbedded silty sand, sandy silt, silt, clayey silt, silty clay, sandy clay, and clayey sand. Boring B-3, 13 meters right of "LNBON2" station 221+43 , elevation 6.8 meters, encountered very soft lean clay with sand to approximately 4 meters overlying interbedded very loose to medium dense silt with sand and silty sand and very soft to very stiff lean clay.

Geotechnical Analysis

Preliminary geotechnical analysis performed for this project were based on the profiles and elevations based supplied by design for the individual locations of the various features of this project. The wall heights are likely to vary depending on the final design configurations. A more comprehensive analysis of the retaining walls will be completed in the Foundation Report for each structure. The preliminary analysis includes external retaining wall stability and settlement. The analysis was performed to determine the feasibility of the retaining wall structures and the sound walls that are proposed throughout the project.

Retaining wall bearing capacity was determined using Meyerhofs' Bearing Capacity Equations in the FHWA computer program CBEAR at rotary boring locations. Bearing capacity at CPT sounding locations was determined using Schmertmanns' method for strip footings on cohesionless soil. Bearing capacity calculated using Schmertmanns' CPT method does not take the retaining wall footing width into consideration. A depth to the bottom of footing to footing width ratio less than 1.5 is the criteria used to determine the bearing capacity of a strip footing. MSE wall foundation pressure was calculated using the methods presented in the FHWA Publication No. RD-89-043, Reinforced Soil Structures, November, 1990, assuming level backfill above the wall and an 11.5 kPa traffic surcharge.

Retaining wall settlement was determined using the method presented in the FHWA Soils and Foundation Workshop for cohesionless soils. The method of superposition was used to determine the increase in vertical stress in the foundation soils due to embankment and retaining wall loading. The increase in vertical stress at various depths and points along the embankment was determined using influence factors for embankment loading (after J. O. Osterberg, Influence Values for Vertical Stresses in Semi-infinite Mass Due to Embankment Loading).

Preliminary Recommendations

Retaining Walls:

For the retaining walls, the following tables show the proposed retaining wall design heights, retaining wall toe pressure for a Type 1 retaining wall with Case 1 loading, ultimate foundation soil bearing capacity, and allowable foundation soil bearing capacity.

The preliminary recommendations are based on wall heights supplied from design. Final recommendations may require greater wall heights and increased toe pressure to accommodate the required minimum cover for the final grades.

Via Real at Casitas Pass Road

Retaining Wall	Max Design Height (meters)	Alternative Number	Type 1 Wall Toe Pressure (Kpa)	Ultimate Bearing Capacity	Allowable Bearing Capacity
A	1.6	1,2,3,4	90	315 kPa	105 kPa
B	1.3	1,2,3,4	90	315 kPa	105 kPa

The preliminary calculations for these walls are based on the 1951 Log of Test Borings in the vicinity of the proposed walls. The datum used to establish the elevation of the boring is likely not current, therefore the final analysis may need to be adjusted to account for differing elevations.

From the 1951 LOTB, the wall is to be founded on loose to med dense silty sand. The ground water was determined to be 2.7 meters (8.8 feet) below the existing ground surface at that time.

Based on the bearing capacity analysis, it appears that a Type 1 wall will be adequate.

An alternative to constructing separate walls in this location would be for Structures to incorporate them with the proposed wingwalls of the Casitas Pass Overcrossing.

Additional subsurface exploration and analysis will be required in the design phase of this project.

Casitas Pass Road Southbound Off-Ramp

Retaining Wall	Design Height (meters)	Alternative Number	Type 1 Wall Toe Pressure	Ultimate Bearing Capacity	Allowable Bearing Capacity
C	1.6	1,2,3,4	90	315 kPa	105 kPa

The preliminary analysis for this proposed structure was referenced from B-4 and CPT 5. B-4 is located approximately 3 meters west of the wall layout line. CPT 5 is located approximately 15 meters east of the wall layout line.

From boring B-4, the area appears to be underlain by very loose to med dense silty sand to about 7.5 meters which overlays interbeded loose to medium dense sandy silt, silty sand and lean clay. The ground water was determined to be approximately 5.6 meters (18.4 feet) below the existing ground surface at the boring location. This corresponds to a subsurface water elevation of 6.6 meters (21.6 feet). As shown on the plans, the bottom of this wall is assumed to be at elevation 11.0 meters (37.1 feet). This boring is located in the residential area located above the highway offramp.

From sounding CPT-5, the ground water elevation and the underlying soil was similar to what was observed in boring B-4. This boring was located in the depressed section of highway adjacent to the existing Casistas Pass Road offramp.

Based on the preliminary analysis of the subsurface data and using the information supplied by design, it appears that a Type 1 wall will be adequate.

Additional subsurface exploration and analysis will be required in the design phase of this project.

Via Real at Vallecito Rd.

Retaining Wall	Design Height (meters)	Alternative	Type 1 Wall Toe Pressure	Ultimate Bearing Capacity	Allowable Bearing Capacity
D	0.6	1,2,3,4	80	315 kPa	105 kPa

The preliminary analysis for this proposed structure was referenced from B-4 and CPT 5. B-4 is located approximately 57 meters west of the wall layout line. CPT 5 is located approximately 37 meters west of the wall layout line.

From boring B-4, the area appears to be underlain by very loose to med dense silty sand to about 7.5 meters which overlays interbeded loose to medium dense sandy silt, silty sand and lean clay. The ground water was determined to be approximately 5.6 meters (18.4 feet) below the existing ground surface at the boring location. This corresponds to a subsurface water elevation of 6.6 meters (21.6 feet).

From sounding CPT-5, the ground water elevation appeared to be consistent and the underlaying soil was similar to what was observed in boring B-4. This sounding was located in the depressed section of the highway adjacent to the existing southbound Casitas Pass Rd offramp.

The profile provided by design indicates that this is a low height retaining wall. Once the final design has been established, the wall heights and required bearing capacity may need to be increased.

Currently, for a maximum wall height of 0.6 meters, it is recommended that an alternative standard retaining structure be considered. An example is found in the 2006 Standard Plans, Retaining Wall Type 6. If the wall heights are increased due to the required depth of burial or grading requirements, it appears that a Type 1 wall will be adequate.

Via Real Near Linden Ave

Retaining Wall	**Design Height (meters)**	**Alternative**	**Type 1 Wall Toe Pressure**	**Ultimate Bearing Capacity**	**Allowable Bearing Capacity**
E	2.0	1,2	105	345 kPa	115 kPa
F	2.0	3	105	345 kPa	115 kPa
G	2.0	4	105	345 kPa	115 kPa

The preliminary analysis for these retaining walls referenced from sounding CPT 3 and sounding CPT 7. CPT 3 is located approximately 33 meters west of the wall location. CPT 7 is located approximately 34 meters west of the wall location. These soundings indicate that the ground water is at approximately 5.2 meters to 5.9 meters in elevation. The proposed bottom of footing depth is shown at an approximate elevation of 7.7 meters.

Based on the preliminary analysis of the subsurface data and using the information supplied by design, it appears that a Type 1 wall will be adequate. If the height of the wall is greater than anticipated, an alternate design such as a Type 1 wall on piles may be required. Due to the presence of high ground water near the surface, driven piles would be likely.

Linden Ave. Overcrossing

Retaining Wall	Design Height (meters)	Alternative	Type 1 Wall Toe Pressure	Ultimate Bearing Capacity	Allowable Bearing Capacity
H	4.5	1,4	160 kPa	345 kPa	115 kPa
I	4.2	2,3	160 kPa	345 kPa	115 kPa

The preliminary analysis for these retaining walls are referenced from sounding CPT 6. CPT 6 is located approximately 20 meters east of the wall location. This sounding indicates that the ground water is at approximately 5.7 meters in elevation and 0.6 meters below the ground surface at this location. Other borings in the vicinity also verify that very high ground water exists in this area. The proposed bottom of footing depth is shown at approximate elevation of 9.6 meters.

As shown on the plans, these walls will likely be placed within the existing embankment fill that was constructed in 1951. The depth of embedment will be based on the global stabililty and the bearing capacity. It is likely that a Type 1 wall will not meet minimum global stability and bearing capacity requirements.

Possible alternatives retaining structures include a Type 1 wall on driven piles or a MSE wall. Additional subsurface exploration and analysis will be required in the design phase of this project.

Linden Ave. Southbound Off-Ramp

Retaining Wall	Design Height (meters)	Alternative	Type 1 Wall Toe Pressure	Ultimate Bearing Capacity	Allowable Bearing Capacity
J	6.3	1,2,3,4	220 KPa	195 kPa	65 kPa
K	6.3	1,2,3,4	220 KPa	195 kPa	65 kPa

The preliminary analysis for these proposed structures was referenced from B-2. B-2 is located approximately 7 meters west of the wall layout line for Wall K and 19 Meters west of Wall J. This boring is located in the gore area between the highway offramp and Linden Avenue.

From Boring B-2, the area appears to be underlain by silt to about 2.1 meters which overlays interbeded loose clay, sandy clay, and silty sand. The ground water was determined to 0.3 meters (1.0 feet) below the existing ground surface at the boring location. This corresponds to an elevation of approximately 7.2 meters. The proposed bottom of footing depth for these walls is shown at approximate elevation of 5.8 meters. Ground water is likely to be a significant issue during construction.

Based on the preliminary analysis of the subsurface data and using the information supplied by design, it appears that a Type 1 wall is not appropriate for the site.

Preliminary analysis indicates that MSE walls will likely met the bearing capacity requirements. Once the final wall heights have been established by design, additional subsurface investigation and analysis will be required. An alternative to the MSE wall would be a Type 1 wall on driven pile footings.

Linden Ave. Northbound On-Ramp

Retaining Wall	Design Height (meters)	Alternative	Type 1 Wall Toe Pressure	Ultimate Bearing Capacity	Allowable Bearing Capacity
L	5.5	1,4	190	471 kPa	157 kPa
M	5.5	1,4	190	471 kPa	157 kPa

The preliminary analysis for this proposed structure was referenced from sounding CPT-8 and boring B-3. CPT-8 is located approximately 25 meters west of the wall layout line for Wall M. Boring B-3 is located approximately 8 meters west of wall M.

From Boring B-3, the area appears to be underlain by very lean clay with sand to about 4.0 meters which overlays interbeded loose silty sand, lean clay and silt with sand. The ground water was determined to 1.4 meters (4.6 feet) below the existing ground surface at the boring location. This corresponds to an elevation of 5.4 meters. The lowest proposed bottom of footing depth for these walls is shown at approximate elevation of 4.8 meters. This boring is located at the end of a residential street adjacent to the right of way fence.

Based on the preliminary analysis of the subsurface data and using the information supplied by design, it appears that a Type 1 wall is not appropriate for the site.

Preliminary analysis indicates that MSE walls will likely met the bearing capacity requirements. Once the final wall heights have been established by design, additional subsurface investigation and analysis will be required. An alternative to the MSE wall would be a Type 1 wall on driven pile footings.

MSE walls are recommended for several of the retaining structures rather than Type 1 retaining walls. The tables above show that bearing capacity requirements are not met for standard Type 1 walls with spread footings at several locations. Because of the flexible nature of reinforced soil structures, MSE walls are more tolerable to differential settlements than cast-in-place concrete cantilever walls. Type 1 retaining walls on pile footings may also be used. Because of high ground water and predominantly cohesionless foundation soils, driven piles are recommended. CIDH piles are not feasible due to high groundwater and caving soil conditions.

The retaining wall bearing capacity and foundation pressures given above are for retaining walls without sound walls. Retaining walls with sound walls on top can be expected to have higher toe pressures than retaining walls without sound walls.

Settlement calculations indicate that approximately 100 mm of settlement can be expected for a retaining wall and embankment 3.7 meters high. Settlement can be expected to be variable depending on embankment / retaining wall heights and location within the project limits.

Sound Walls:

For the sound walls, the following tables show the proposed sound wall design heights, assumed Case type, and the assumed Phi for the existing soil conditions.

The preliminary recommendations are based on sound wall heights supplied from design. Final recommendations may need to be adjusted once the final ground line details have been established and additional subsurface exploration has been completed.

Sound Wall	Design Height (meters)	Alternative	Assumed Case	Assumed Phi
B1	3.7	1,4	1	30
B2	3.7	1,2,3,4	2	30

Analysis for this sound wall is from Boring B-3 and CPT 8, CPT 9, CPT 10. The soil in this area is very soft lean clay with sand and very loose silty sand with high ground water. The ground water is near the surface with a ground water depth that varies from 1.0 to 2.0 meters below the existing ground surface.

A portion of sound wall B-2 will be located on located on top of Retaining Wall M.

Due to a high ground water regime and weak soils, it is recommended that the sound walls be placed on driven piles.

Sound Wall	**Design Height (meters)**	**Alternative**	**Assumed Case**	**Assumed Phi**
B3	2.4	1,2,3,4	2	30

Analysis for this wall is from Linden Ave Overcrossing LOTB. The soil in this area was soft sandy clay and clayey silt above slightly compact sand and very stiff clayey silt and silt with high ground water. The ground water is near the surface with a ground water depth that varies from approximately 1.0 to 1.5 meters below the existing surface.

Due to a high ground water regime and weak soils, it is recommended that the sound walls be placed on driven piles.

Sound Wall	**Design Height (meters)**	**Alternative**	**Assumed Case**	**Assumed Phi**
B4	3.7	1,2,3,4	1	30
B5	3.7	1,2,3,4	1	30
B6	3.7	1,2,3,4	1	30

Sound Wall	Design Height (meters)	Alternative	Assumed Case	Assumed Phi
B8	3.7	1,2,3,4	1	30

Analysis for these walls (B-4 thru B-8) is from 1951 LOTB for Castitas Pass Road Overcrossing. From the 1951 LOTB, the walls are to be founded on loose to med dense silty sand. The ground water was determined to be 2.7 meters (8.8 feet) below the existing ground surface at that time.

Preliminary analysis indicates that adequate bearing capacity and reasonable ground water depths appear to allow for any of the alternate sound wall foundations to be used. Additional subsurface exploration and analysis will be required in the design phase of this project to determine the appropriate foundation type.

Sound Wall	Design Height (meters)	Alternative	Assumed Case	Assumed Phi
B7	3.0	1,2,3,4	2	30

The preliminary analysis for this proposed sound wall was referenced from B-4. B-4 is located approximately 3 meters west of the sound wall layout line.

From Boring B-4, the area appears to be underlain by very loose to med dense silty sand to about 7.5 meters which overlays interbeded loose to medium dense sandy silt, silty sand and lean clay. The ground water was determined to be approximately 5.6 meters (18.4 feet) below the existing ground surface at the boring location. This boring is located in the residential area located above the highway offramp.

Preliminary analysis indicates that reasonable ground water depths allow for any of the alternate sound wall foundations to be used. A portion of B-7 will be located on located on top of Retaining Wall C.

Additional subsurface exploration and analysis will be required in the design phase of this project to determine the appropriate foundation type.

Sound Wall	Design Height (meters)	Alternative	Assumed Case	Assumed Phi
B9	3.0	1,2,3,4	2	30

Analysis for this wall is from Boring B-1. The soil in this area consists of very soft silt with sand and silt over loose silty sand with high ground water. The ground water is near the surface with a ground water depth that varies from approximately 0.5 meters to 1.5 meters below the existing surface.

Due to a high ground water regime and weak soils, it is recommended that the sound walls be placed on driven piles. Additional subsurface exploration and analysis will be required in the design phase of this project.

Cut Slopes:

Cut slopes and embankments shall have slope angles of 1:2 (V:H) or flatter. Where slopes steeper than 1:2 are desired, geosynthetic reinforcement will be required for slope angles to 1:1.5. Geosynthetic reinforcement will prevent shallow slides and surficial slumping from occurring when the slope is saturated. It will also allow the slopes to be designed with a global stability factor of safety of 1.5 or greater. The native material and imported borrow that is locally available is generally fine grained with poor compaction characteristics and relatively low shear strength. This material is also highly susceptible to erosion. An aggressive revegetation program, possibly including irrigation, will be required on both cut and fill slopes.

Construction Considerations

Unsuitable or saturated foundation soil are likely to be encountered during footing excavation for the proposed retaining walls and sound walls. Sub-excavating and placing a layer of gravel encapsulated in geotextile fabric below the wall footings may be necessary. Details, specifications, and limits of sub-excavation will be provided in the Geotechnical Design Report.

Due to evidence of foundation soil settlement caused by embankment loading at Linden Ave, it is likely a fill delay period and / or a fill surcharge will be required before placement of the bridge piles and the pavement structural section. This will help prevent development of a "bump" at the end of the bridge and prevent load reversal and downdrag on the bridge piles.

If you have any questions or comments, please contact Zeke De Llamas at (805) 549-3327 or Mike Finegan at (805) 549 –3194.

Report Prepared by:

REGISTERED PROFESSIONAL ENGINEER
ZEKE C. DELLAMAS
No. C 67457
Exp. 6/30/2009
CIVIL
STATE OF CALIFORNIA

ZEKE DE LLAMAS, PE
Transportation Engineer
Geotechnical Design – North
Branch D

Supervised by:

MIKE FINEGAN, PE
Branch Chief
Geotechnical Design - North
Branch D

c: GDN Records
GS Records
Branch D Records

List of Attachments

INDEX OF SHEETS

Dist	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SB	101	3.5/5.5		

STATE OF CALIFORNIA

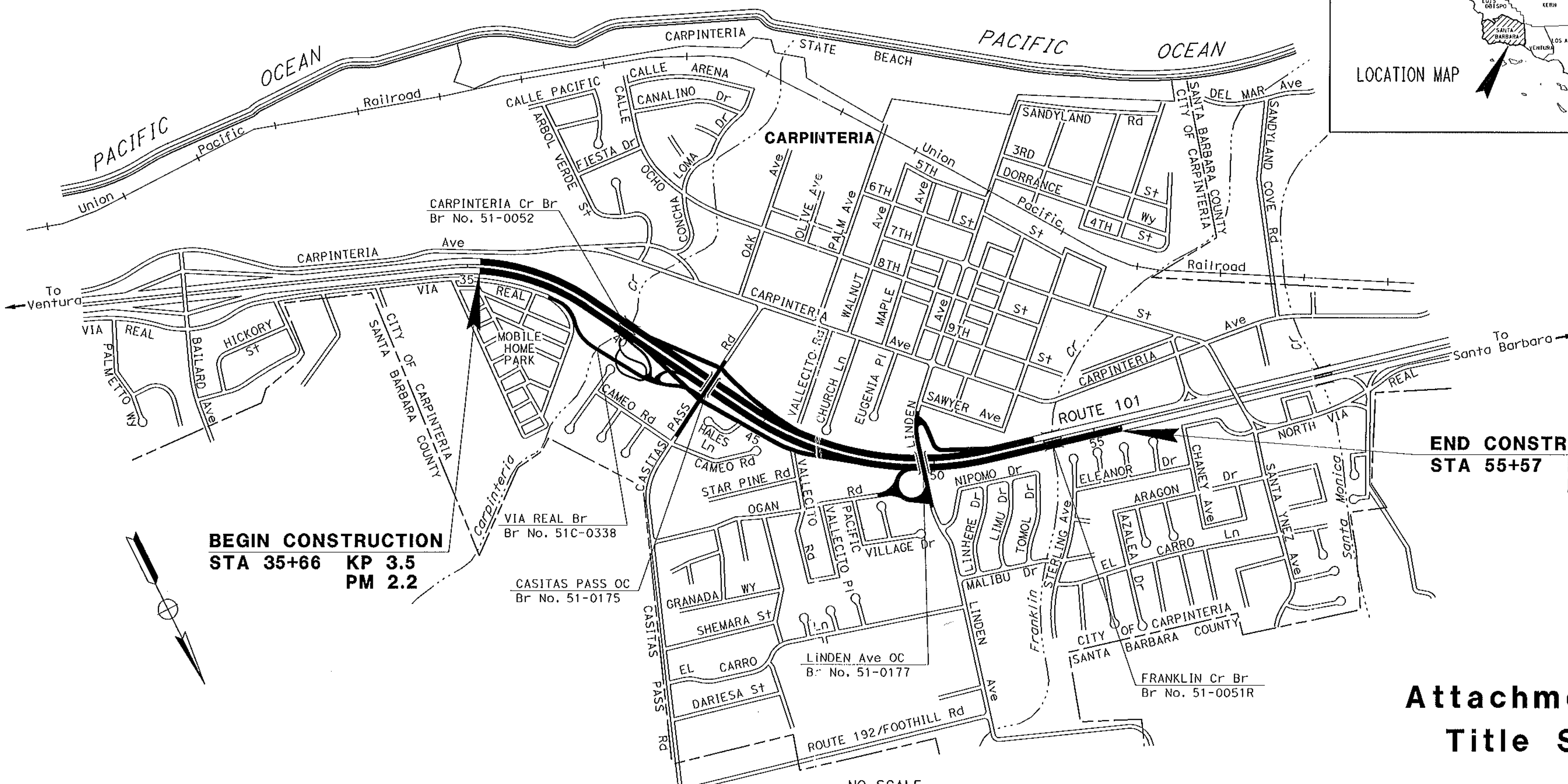
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN SANTA BARBARA COUNTY
IN CARPINTERIA
FROM 0.4 KM SOUTH OF CARPINTERIA CREEK BRIDGE
TO 0.5 KM NORTH OF LINDEN AVENUE OVERCROSSING

TO BE SUPPLEMENTED BY STANDARD PLANS DATED JULY 2004



THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO CONTRACTORS."

PROJECT MANAGER: DAVID BEARD

DESIGN ENGINEER: KARI BHANA

Attachment 1
Title Sheet

CONTRACT No. **05-4482U0**

CU 06233 | EA 4482U0

LAST REVISION 01-09-08

DATE PLOTTED => 29-JUL-2008
TIME PLOTTED => 13:52

NOTE:

FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

Caltrans Metric

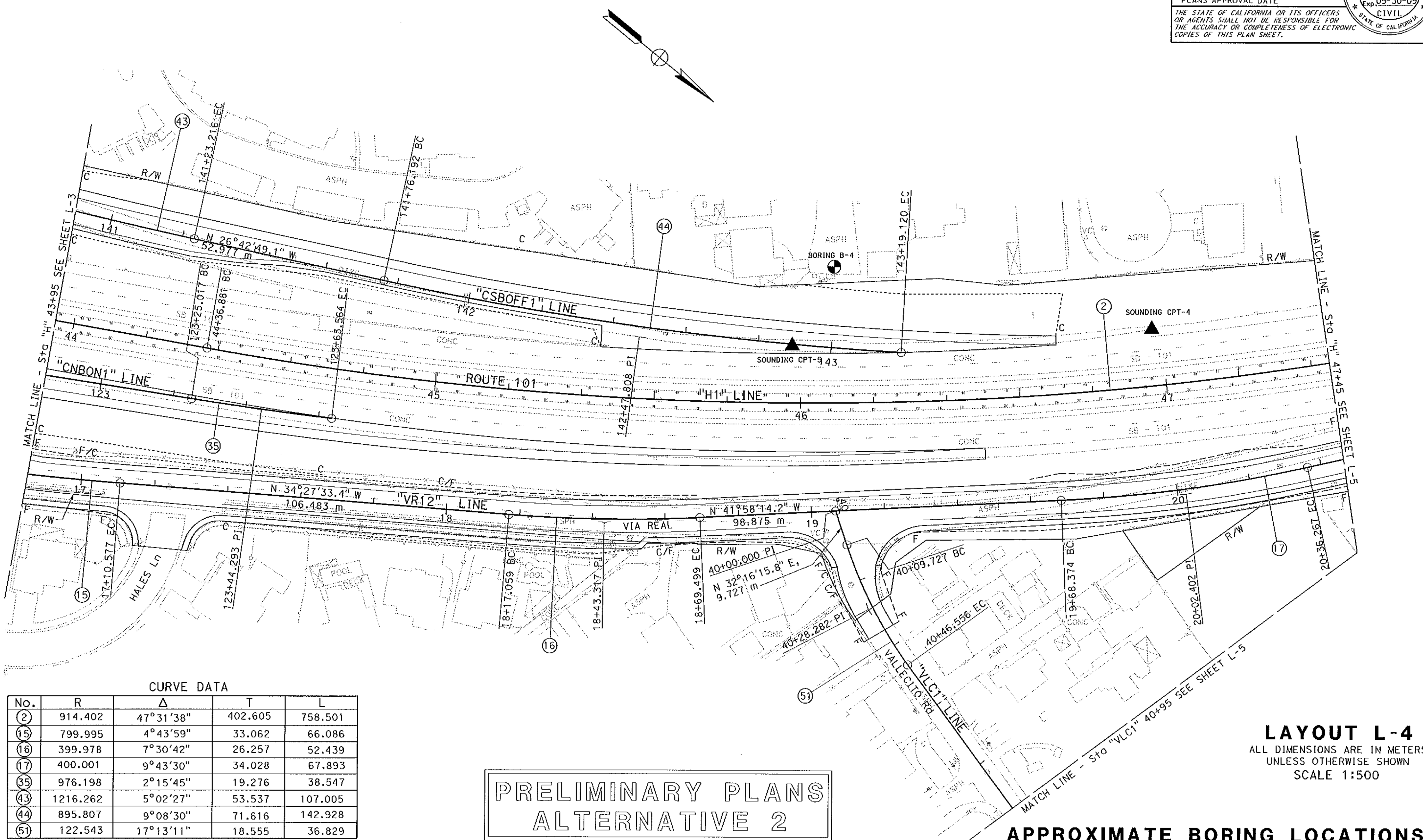
Dist	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SB	101	3.4/5.5		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER KARI BHANA No. 65395 Exp. 09-30-09 CIVIL STATE OF CALIFORNIA



CURVE DATA

No.	R	Δ	T	L
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15	799.995	4°43'59"	33.062	66.086
16	399.978	7°30'42"	26.257	52.439
17	400.001	9°43'30"	34.028	67.893
35	976.198	2°15'45"	19.276	38.547
43	1216.262	5°02'27"	53.537	107.005
44	895.807	9°08'30"	71.616	142.928
51	122.543	17°13'11"	18.555	36.829

PRELIMINARY PLANS ALTERNATIVE 2

LAYOUT L-4

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SCALE 1:500

APPROXIMATE BORING LOCATIONS

Attachment 2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans DESIGN

FUNCTIONAL SUPERVISOR W. D. O'HALLORAN

CALCULATED-DESIGNED BY

CHECKED BY

REVISED BY

DATE REVISED

LAST REVISION 04-22-08

DATE PLOTTED => 29-JUL-2008

TIME PLOTTED => 16:19

BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN MILLIMETERS

0 20 40 60 80

USERNAME => s126010

DGN FILE => Attachment 2-1 - Borings.dgn

CU 06233

EA 4482U0

Dist	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SB	101	3.4/5.5		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER KARI BHANA No. 65395 Exp. 09-30-09 CIVIL STATE OF CALIFORNIA

Caltrans Metric

NOTE:

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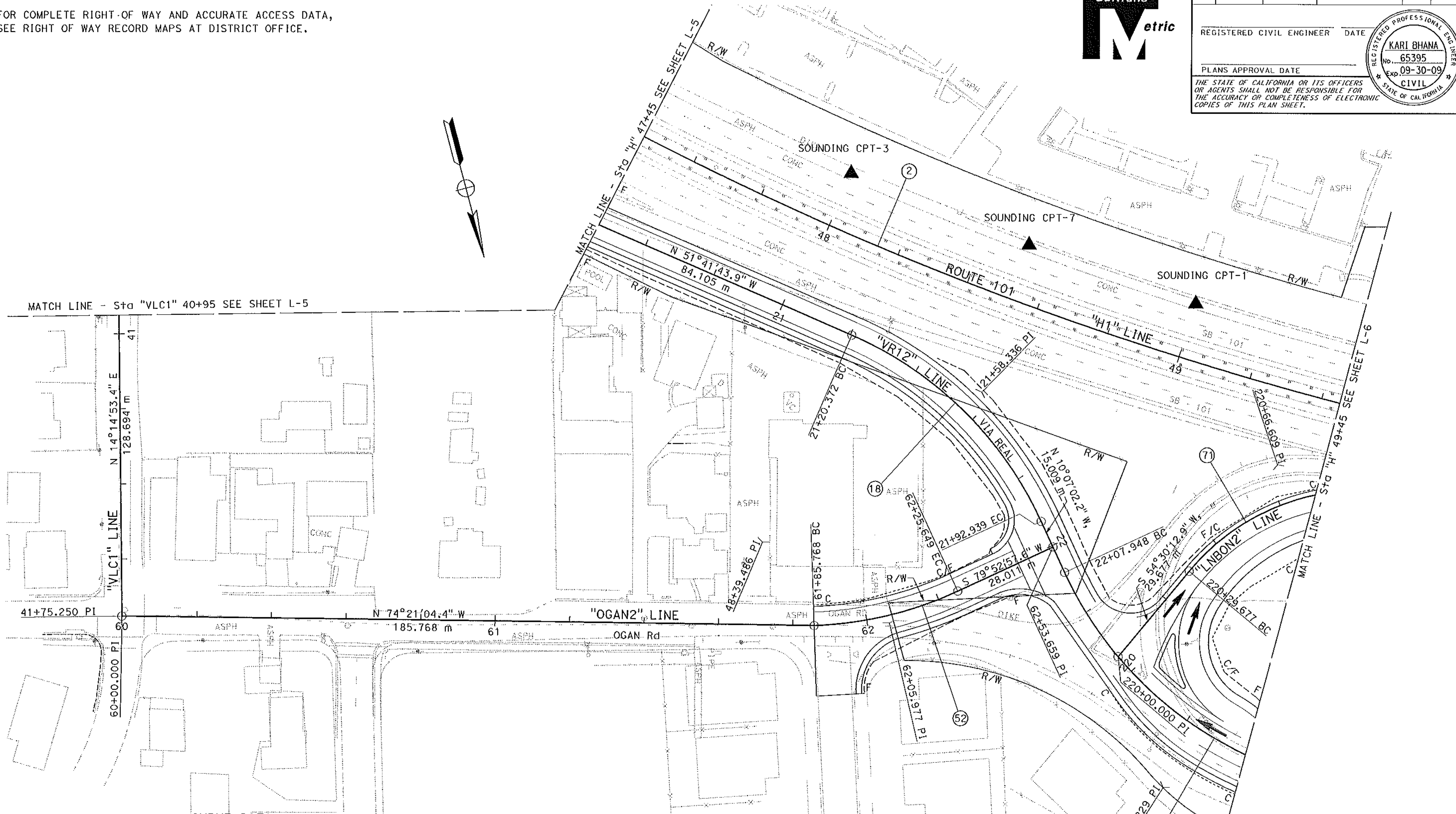

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18	100.000	41°34'42"	37.965	72.568
19	100.000	64°39'07"	63.281	112.839
52	100.002	22°50'58"	20.209	39.880
71	60.000	63°13'38"	36.932	66.212

PRELIMINARY PLANS
ALTERNATIVE 2

LAYOUT L-5

SCALE 1:500
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

APPROXIMATE BORING LOCATIONS
Attachment 2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR W. D. O'HALLORAN
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED

LAST REVISION 04-22-08
DATE PLOTTED => 29-JUL-2008
TIME PLOTTED => 16:22

BORDER LAST REVISED 3/1/2007
RELATIVE BORDER SCALE IS IN MILLIMETERS 0 20 40 60 80
USERNAME => s126010
DGN FILE => Attachement 2-2 Borings.dgn
CU 06233
EA 4482U0

NOTE:

FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

Dist	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SB	101	3.4/5.5		

Caltrans Metric

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER KARI BHANA No. 65395 Exp. 09-30-09 CIVIL STATE OF CALIFORNIA

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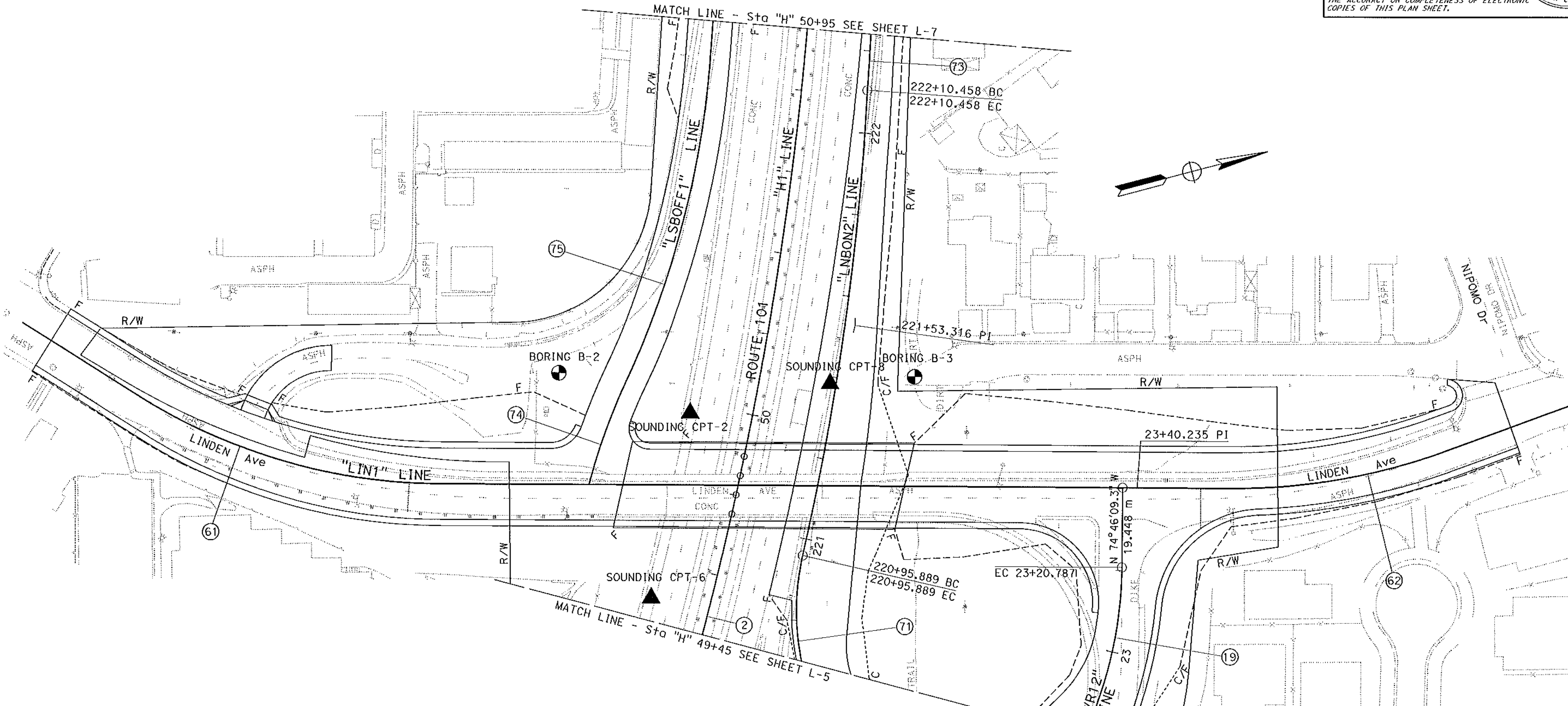

CURVE DATA

No.	R	Δ	T	L
2	914.402	47°31'38"	402.605	758.501
19	100.000	64°39'07"	63.281	112.839
61	140.001	31°50'03"	39.925	77.786
62	150.000	20°15'16"	26.793	53.026
71	60.000	63°13'38"	36.932	66.212
72	663.285	9°53'48"	57.427	114.569
73	1115.399	5°37'33"	54.805	109.522
74	153.599	10°49'35"	14.555	29.024
75	227.695	20°21'58"	40.899	80.935

PRELIMINARY PLANS
ALTERNATIVE 2

LAYOUT L-6

SCALE 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

APPROXIMATE BORING LOCATIONS

Attachment 2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans DESIGN

FUNCTIONAL SUPERVISOR W. D. O'HALLORAN

CALCULATED-DESIGNED BY | CHECKED BY

REVISED BY | DATE REVISED

LAST REVISION 04-22-08 | DATE PLOTTED => 29-JUL-2008 | TIME PLOTTED => 16:30

BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN MILLIMETERS 0 20 40 60 80

USERNAME => s126010
DGN FILE => Attachment 2-3 Borings.dgn

CU 06233

EA 4482U0

Dist	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SB	101	3.4/5.5		

Caltrans Metric

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER KARI BHANA No. 65395 Exp. 09-30-09 CIVIL STATE OF CALIFORNIA

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NOTE:

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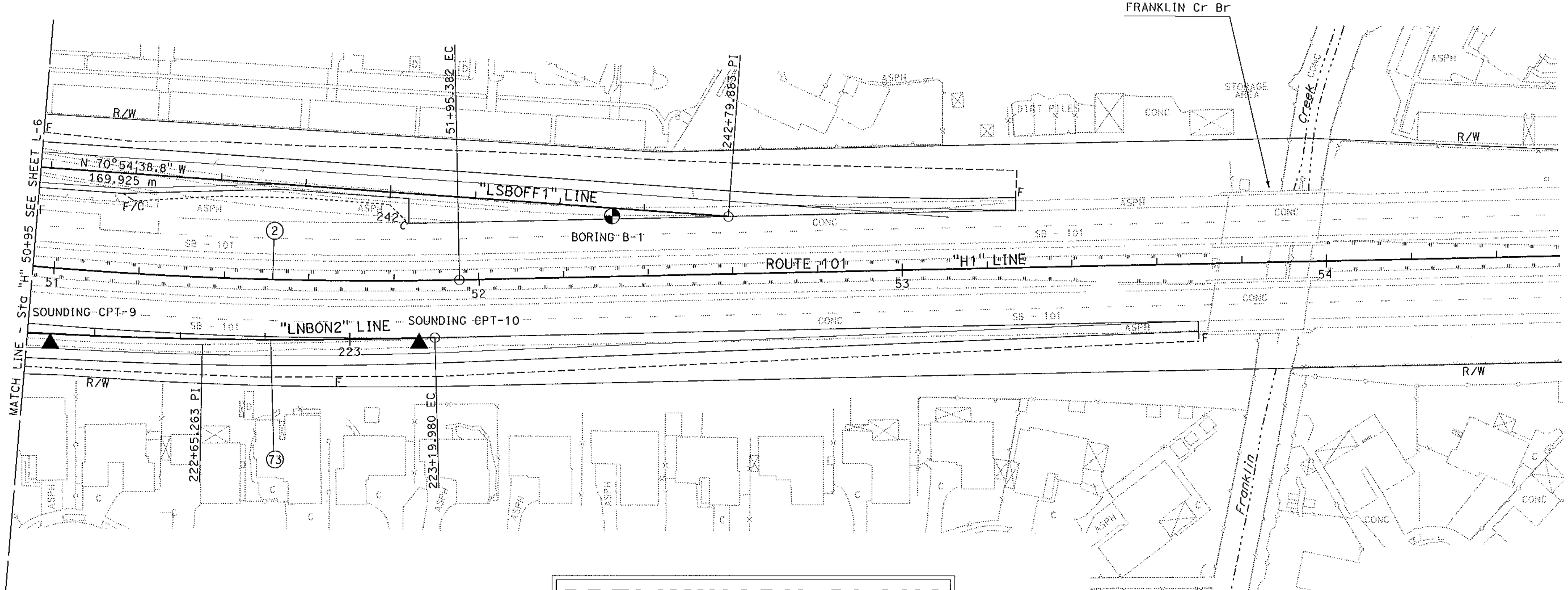

PRELIMINARY PLANS
ALTERNATIVE 2

CURVE DATA

No.	R	Δ	T	L
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73	1115.399	5°37'33"	54.805	109.522

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans DESIGN

FUNCTIONAL SUPERVISOR W. D. O'HALLORAN

CALCULATED-DESIGNED BY | CHECKED BY

REVISED BY | DATE REVISED

LAYOUT L-7

SCALE 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

APPROXIMATE BORING LOCATIONS

Attachment 2

LAST REVISION 04-22-08 | DATE PLOTTED => 29-JUL-2008 | TIME PLOTTED => 16:32

BORDER LAST REVISED 3/1/2007 | RELATIVE BORDER SCALE IS IN MILLIMETERS 0 20 40 60 80 | USERNAME => s126010 DGN FILE => Attachment 2-4 Borings.dgn | CU 06233 | EA 4482U0

Proposed Retaining Walls

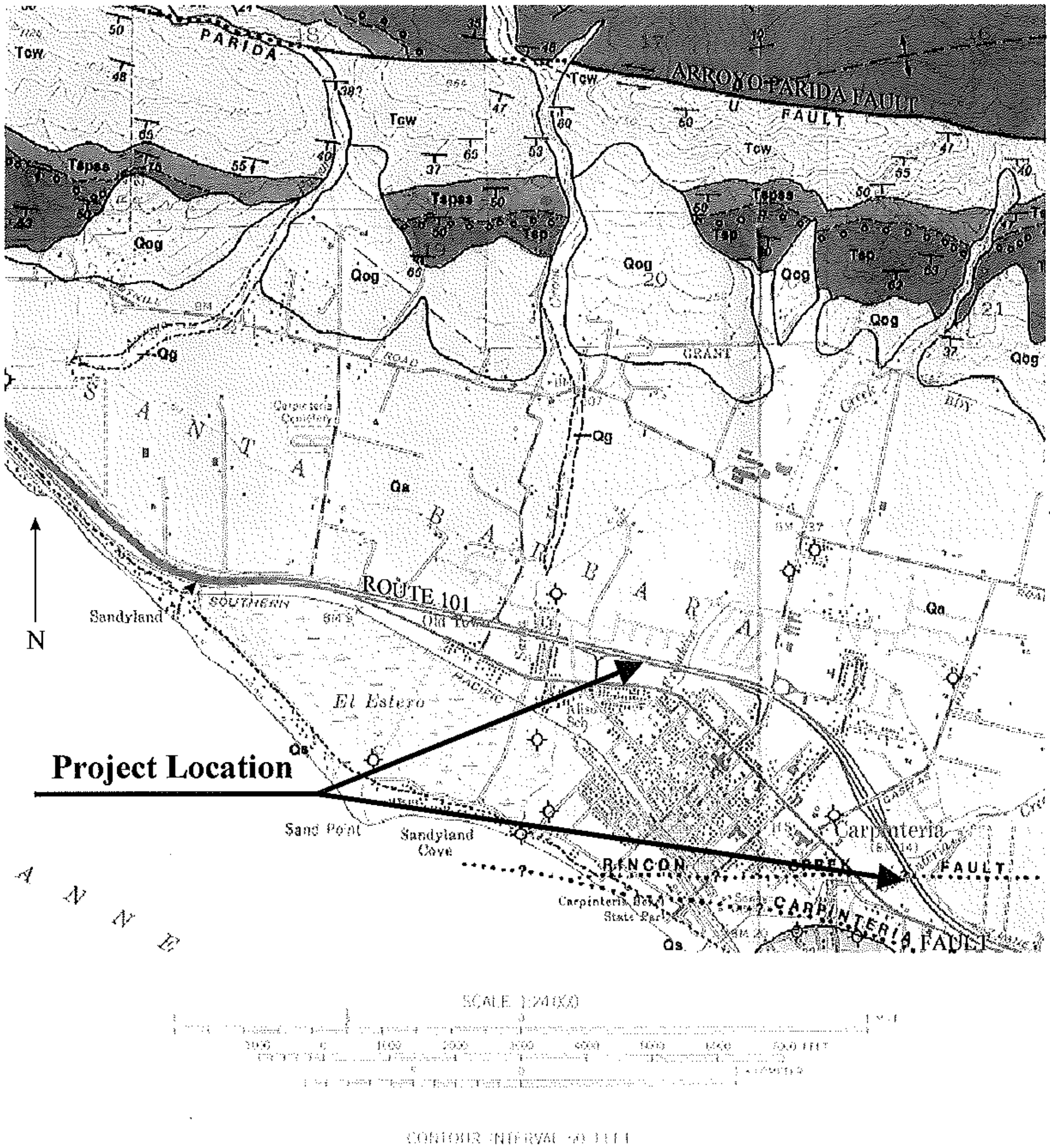
No.	Alternatives	Location	Height	Length
A	1,2,3,4	SB Via Real, between the NB hook ramps and Casitas Pass Road	1.4 m-1.6 m (4.6 ft-5.2 ft)	29.7 m (97.4 ft)
B	1,2,3,4	SB Via Real, between Casitas Pass Road and Hales Lane	0.8 m-1.3 m (2.6 ft-4.3 ft)	31.0 m (101.7 ft)
C	1,2,3,4	SB Casitas off-ramp, between Linden Avenue and Casitas Pass Road	0.0 m-1.6 m (0.0 ft-5.2 ft)	180.4 m (591.9 ft)
D	1,2,3,4	SB Via Real, in the vicinity of Vallecito Road	0.2 m-0.6 m (0.7 ft-2.0 ft)	90.5 m (296.9 ft)
E	1,2	SB Via Real, between Vallecito Road and Ogan Road	0.5 m-2.0 m (1.6 ft-6.6 ft)	107.7 m (353.4 ft)
F	3	SB Via Real, between Vallecito Road and Ogan Road	0.4 m-2.0 m (1.3 ft-6.6 ft)	102.0 m (334.7 ft)
G	4	SB Via Real, between Vallecito Road and Ogan Road	0.9 m-2.0 m (3.0 ft-6.6 ft)	97.5 m (319.9 ft)
H	1,4	EB Linden Avenue, between Sawyer Avenue and Route 101	0.5 m-4.6 m (1.6 ft-15.1 ft)	97.0 m (318.3 ft)
I	2,3	EB Linden Avenue, between Sawyer Avenue and Route 101	0.5 m-4.2 m (1.6 ft-13.8 ft)	96.3 m (316.0 ft)
J	1,2,3,4	SB Linden off-ramp, between Linden Avenue and Franklin Creek	0.4 m-6.3 m (1.3 ft-20.7 ft)	119.2 m (391.1 ft)
K	1,2,3,4	SB Linden off-ramp, between Linden Avenue and Franklin Creek	1.4 m-6.4 m (4.6 ft-21.0ft)	76.2 m (250.0 ft)
L	1,4	NB Linden on-ramp, between Linden Avenue and Franklin Creek	0.3 m-5.6 m (1.0 ft-18.4 ft)	104.2 m (341.9 ft)
M	1,4	NB Linden on-ramp, between Linden Avenue and Franklin Creek	0.8 m-5.6 m (2.6 ft-18.4 ft)	289.3 m (949.2 ft)

Attachment 3

Proposed Sound Walls

No.	Location	Height	Length
B1	NB Route 101, from Franklin Creek to the north project limit	3.7 m (12 ft)	203.3 m (667 ft)
B2	NB Route 101, from Linden Ave to Franklin Creek	3.7 m (12 ft)	370.9 m (1217 ft)
B3	NB Via Real, from Pacific Village Dr to Linden Ave	2.4 m (8 ft)	175.0 m (574 ft)
B4	NB Via Real, between Vallecito Rd and Ogan Rd	3.7 m (12 ft)	121.0 m (397 ft)
B5	NB Via Real, between Hales Ln and Vallecito Rd	3.7 m (12 ft)	27.7 m (91 ft)
B6	NB Via Real, between Hales Ln and Vallecito Rd	3.7 m (12 ft)	77.4 m (254 ft)
B7	SB Casitas off-ramp, between Linden Ave and Casitas Pass Rd	3.0 m (10 ft)	217.0 m (712 ft)
B8	NB Via Real, between Vallecito Rd and Ogan Rd	3.7 m (12 ft)	57.9 m (190 ft)
B9	SB Linden off-ramp, between Linden Ave and Franklin Creek	3.0 m (10 ft)	64.0 m (210 ft)

Attachment 4



PART OF:

GEOLOGIC MAP OF THE CARPINTERIA QUADRANGLE
BY THOMAS W. DIBBLEE, JR., 1986

Geologic Map

05-SB-101-2.1/3.4
05-4482U0

ATTACHMENT 5

LEGEND

GEOLOGY - CARPINTERIA QUADRANGLE

QUATERNARY

Holocene

Qs / Qg / Qa

SURFICIAL SEDIMENTS

Qs *beach sand deposits*
Qg *stream channel deposits, mostly gravel and sand*
Qa *alluvium: unconsolidated flood-plain deposits of silt, sand and gravel*

Qls

LANDSLIDE DEBRIS

Pleistocene

Qoa / Qog

OLDER DISSECTED SURFICIAL SEDIMENTS

Qoa *former alluvial deposits of silt, sand and gravel, in places weakly consolidated; local unconformities at base*
Qog *cobble-boulder fan gravel and fanglomerate deposits composed largely of sandstone detritus*

UNCONFORMITY

Qca

CASITAS FORMATION

nonmarine; early to middle(?) Pleistocene age

Qca *weakly consolidated alluvial deposits: gray to tan cobble-boulder gravel and gray to reddish sand and clay*

UNCONFORMITY

Miocene

Tm / Tml

MONTEREY FORMATION

marine; early to late Miocene age

Tm *upper shale unit: white-weathering, thin bedded, hard, platy to brittle siliceous shale; Mohnian Stage*
Tml *lower shale unit: white weathering, soft, fissile to punky clay shale with interbeds of hard siliceous shale and thin limestone strata; lower Mohnian to uppermost Saucesian Stages*

Tmss

UNNAMED SANDSTONE (TEMBLOR SANDSTONE OF DIBBLEE, 1966)

shallow marine; early Miocene age

Tmss *light gray to tan fossiliferous arkosic sandstone and pebble conglomerate; local unconformity(?) at base; exposed north of Santa Ynez fault*

Tr

RINCON SHALE

marine; early Miocene age

Tr *poorly bedded gray clay shale and siltstone, locally concretionary; Saucesian and upper Zemorrian Stages*

Tvq

PART OF:

GEOLOGIC MAP OF THE CARPINTERIA QUADRANGLE BY THOMAS W. DIBBLEE, JR., 1986

Geologic Map – Legend

05-SB-101-2.1/3.4
05-4482U0

ATTACHMENT 5

TERTIARY

Oligocene

Tsp / Tspss

SESPE FORMATION

nonmarine; predominantly Oligocene age

Tsp *maroon, red and green silty shale or claystone with interbedded red, tan and gray sandstone; red arkosic sandstone and conglomerate at base*
Tspss *red to pink sandstone and red claystone*

Eocene

Tcw / Tcwsh

COLDWATER SANDSTONE

marine; late Eocene age

Tcw *hard, tan, bedded arkosic sandstone with minor interbeds of greenish-gray siltstone and shale, local oyster shell beds common in upper part; Narizian Stage*
Tcwsh *greenish-gray siltstone and shale with occasional interbeds of tan sandstone*

Tcd / Tcdss

COZY DELL SHALE

marine; late Eocene age

Tcd *dark gray, argillaceous to silty micaceous shale with minor light gray to tan arkosic sandstone; Narizian Stage*
Tcdss *light gray to tan arkosic sandstone with minor interbeds of gray micaceous shale*

Tma / Tmash

MATILIJA SANDSTONE

marine; middle to late Eocene age

Tma *hard, thick bedded, tan to mottled light greenish gray arkosic sandstone with thin partings to thick interbeds of gray micaceous shale; lower Narizian and upper Ulatisian Stages*
Tmash *gray micaceous shale with minor tan sandstone interbeds; exposed north of Santa Ynez fault*

Tjsh / Tjss

JUNCAL FORMATION

marine; early to middle Eocene age

Tjsh *dark gray micaceous shale with minor thin interbeds of hard, gray-white to tan arkosic sandstone; lower Ulatisian(?) to upper Penutian(?) Stages*
Tjss *hard, gray-white to tan arkosic sandstone with minor interbeds of dark gray micaceous shale*

Tsb / Tsbs

SIERRA BLANCA LIMESTONE

shallow marine; early Eocene age (exposed north of Santa Ynez fault)

Tsb *hard, white-weathering sandy algal limestone*
Tsbs *hard, light gray calcareous sandstone, locally fossiliferous*

UNCONFORMITY

CRETACEOUS

Upper

Ksh / Kuss / Kucg / Kush

UNNAMED MARINE STRATA

(Kush, Kuss, Kucg - Jalama ? Formation) late Cretaceous age

Ksh *gray micaceous clay shale with minor interbeds of hard, gray-white to tan arkosic sandstone; exposed north of Santa Ynez fault*
Kush *dark gray to black micaceous clay shale with minor interbeds of hard tan arkosic sandstone*
Kucg *gray to brown cobble conglomerate of granitic, porphyritic-andesitic, and quartzitic detritus in arkosic sandstone matrix*
Kuss *hard, light gray to tan arkosic sandstone with minor interbeds of micaceous shale*

Lower

Ke

ESPADA FORMATION

marine; late Jurassic (?) to early

Ke *dark greenish-gray carbonaceous shale with thin interbeds of hard, olive-gray arkosic sandstone and minor dark gray impure limestone*

JURASSIC & CRETACEOUS

sp

SERPENTINITE

metamorphosed intrusive rock

sp *severely sheared, bluish-green to black serpentinite and serpentinized peridotite in Santa Ynez Fault zone*

fg / fc / fs / gl

FRANCISCAN ASSEMBLAGE

slightly metamorphosed, pervasively sheared assemblage of marine sedimentary, igneous and metamorphic rocks

fg *greenish-brown to black, massive to crudely bedded, fine grained greenstone, metamorphosed from basalt*
fc *thin bedded, hard and brittle, varicolored green to red chert*
fs *greenish-brown, hard graywacke sandstone and dark gray micaceous siltstone and shale, moderately to severely sheared, in part to mélange*
gl *hard, deep blue glaucophane blueschist*

SYMBOLS

FORMATION CONTACT
dashed where inferred or indefinite

MEMBER CONTACT

CONTACT BETWEEN SURFICIAL SEDIMENTS
located approximately in places

U D 70 ?

FAULT
dashed where indefinite or inferred, dotted where concealed, queried where existence doubtful. Parallel arrows indicate inferred relative lateral movement. Relative vertical movement shown by U/D (U = upthrown side D = downthrown side). Short arrow indicates dip of fault plane.

ANTICLINE **SYNCLINE**
arrow on axis indicates direction of plunge, dotted where concealed

horizontal — 25 *inclined* — 20 *inclined (approximate)* — *vertical* — 25 *overturned* — 25 *inclined metamorphic foliation*

STRIKE AND DIP OF BEDDED ROCKS

Qls

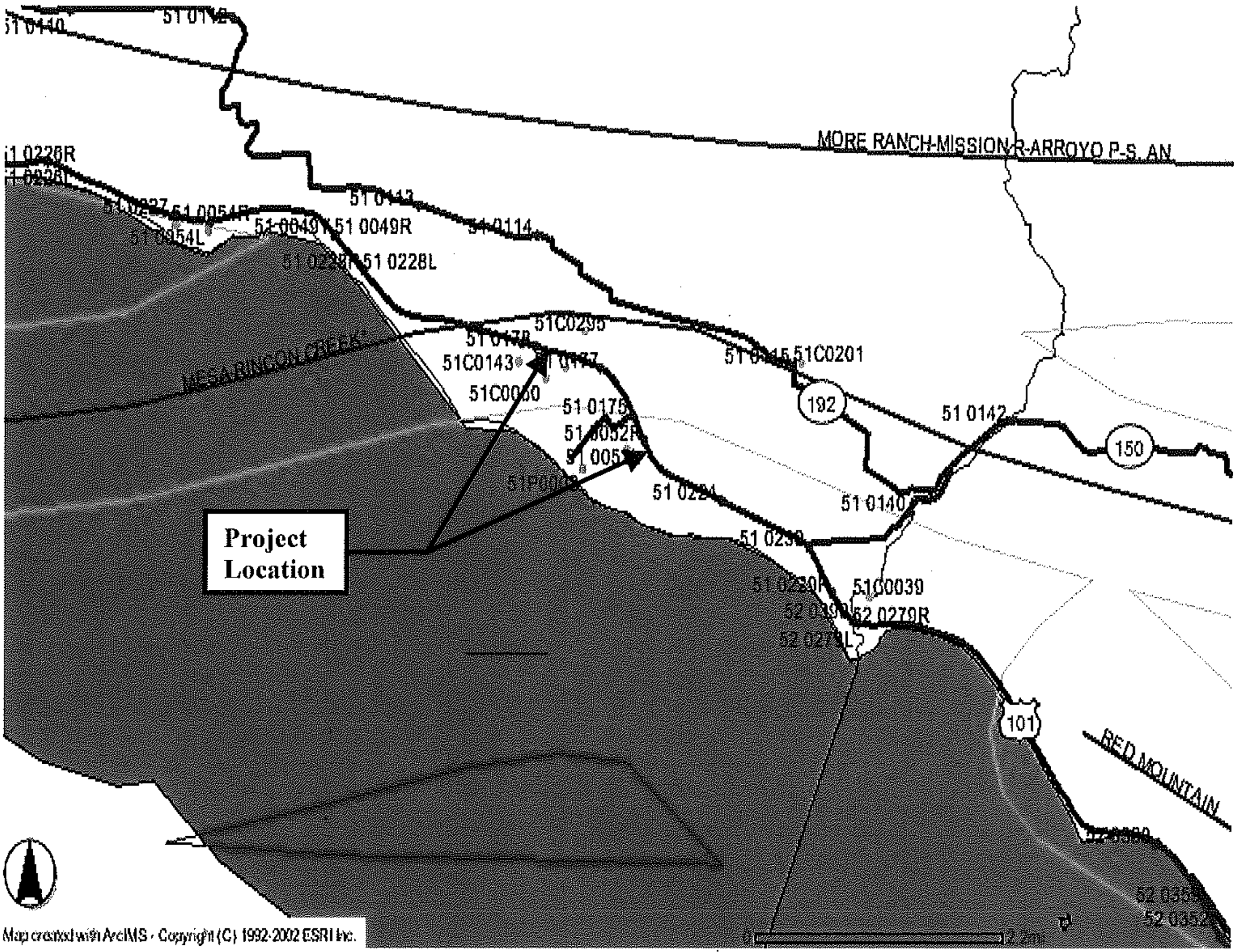
DIRECTION OF LANDSLIDE MOVEMENT

SANDSTONE BED

CONGLOMERATE BED

ABANDONED EXPLORATORY OIL WELL

GEOLOGY - CARPINTERIA QUADRANGLE



CALTRANS Division of Engineering Services Geotechnical Services Office of Geotechnical Design North	EA: 05-4482U0 July 17, 2008	**Seismic Hazard Map** **Linden Ave–Casitas Pass RD**	
	05-SB-101-KP3.4/5.5 (PM 2.1/3.4) **Preliminary Geotechnical Report**		Attachment No. 6